use in my work I have accumulated a considerable collection of wild varieties of *Primula acaulis*, some of which have been kept merely for observation, whilst others have been used for experimental work in genetics, in the course of which facts having some bearing on the colour problem have emerged.

As was inevitable, I obtained the red-flowered form of the primrose very early, and soon noted its occurrence in restricted areas. In Northumberland and Durham I know it from only two wild stations, one on the coal measures of North Durham, and the other in a ravine on the slopes of Kilhope Law, at the head of West Allendale, in Northumberland. The latter is far above the levels of gardens, and nearly 800 ft. above the range of the cowslip, so that the possibility of hybridity is excluded. Nevertheless, all the plants bear red flowers.

With the view of testing how the red colour was inherited, several plants were transferred in spring, 1915, from an elevation of above 1500 ft. to our garden only 30 ft. above sea-level. Although these plants produced red flowers in their first season, just as their relatives did in their mountain home, I made no crosses that year, intending to let the plants establish themselves. To my amazement, however, in 1916, when they flowered, their colour was exactly that of the normal primrose, and as long as I kept the plants—until 1918—only normally coloured flowers appeared. On the other hand, plants brought from Kilhope Law to the Vicarage garden at Ninebanks (elevation just above 1000 ft.) showed no change whatever in flower colour.

From the above it is clear that the altitudes at which the plants grow have something to do with the problem, and that the actual agency may be the average temperature is indicated by the failure of some rose-coloured varieties of *Primula sinensis* to develop their proper colour unless a certain temperature is attained.

Further evidence, indicating that the same influence is at work, appears in the form of two other primroses in my possession brought from a height of 1200 ft. in Upper Teesdale. These bear yellow flowers much deeper in hue than usual, and, in addition, clothed with a dense vestiture of white hairs. As the cowslip ascends in Teesdale to the limestone of Harwood Dale (at 1600 ft.) hybridity is not excluded here, but against this is the fact that although I have examined hundreds of primrose-cowslip hybrids I have never encountered a plant in the least like these.

The insect to which Major Latham refers as the "primrose sprite" is no doubt *Bombylius major*, a fly often to be seen poised, with proboscis extended, over primroses in April. Aiding it in the work of pollination, but carrying on their operations in a more or less illicit fashion, are the thrips, *Taeniothrips primulae*, and larvæ of the Geometrid moth, *Larentia didymata*.

J. W. Heslop Harrison.

Armstrong College,
Newcastle-upon-Tyne, May 7.

## Earthworms Drowned in Puddles.

The explanation suggested by Sir E. Ray Lankester (Nature, May 12, p. 329) of the occurrence of dead earthworms in surface "puddles" described by Mr. Friend had occurred to me, viz. that they were drowned. As to the survival of such worms in cool, clear, running water for some time, it is well known to most "bottom" fishermen that worms will survive for a considerable time *on a hook* in such water, and it is conceivable that their ultimate death is due to a too free exchange between the body-fluid and the surrounding water at the wounds made by the hook rather than to inability to breathe.

I walk warily in dealing with zoological matters, but I may suggest that with the breathing apparatus described the "moist surface" must, when underground, frequently or usually be in contact with other moist surfaces, so that the worm is, in effect, partly immersed in water. The great advantage of breathing through the agency of a moist *film*, as the worm does when above ground and as mammals do, is that the exchanges between air and blood can take place very rapidly owing to the steep gradient of oxygen tension in the film. An animal normally living in water has to expend a great deal of energy in pumping water through its respiratory system in order to get enough oxygen to support life. Fish when in water very far from saturated with oxygen or saturated at a relatively high temperature are unable to get the water through their gills at a sufficient speed; in the latter case the temperature coefficient of vital activity is against them, as they live faster at higher temperatures.

The oxygen dissolved in water is very small in amount. At 15° C. it is about 7 c.c. per litre, or one part by weight in 100,000. The oxidisable matter in moderately contaminated water will consume about 0·2 to 0·4 part of oxygen in five days at 18° F. (Adeney's test). The consumption of oxygen would naturally be relatively rapid in the early stages. Rain-water is approximately saturated with oxygen, but the considerable mass of oxidisable matters in dead and rotting leaves might easily take up the dissolved oxygen much more rapidly than re-absorption could take place in a stagnant pool of appreciable depth. If so, the worms which might manage to keep going for a time in well-aerated water, although with difficulty, would die in water which did not continually provide a surface layer fully saturated with oxygen in contact with their skin.

I hope to be able to make some quantitative investigation of the matter.

J. H. Coste.

Teddington, May 13.

## The Physical Continuity of "Space."

In the "space-æther" discussion clarity is lost by a failure to distinguish between "container" and "content." The relativist does not assert that there is no content. He is concerned with the geometry of the container; if this geometry assists the metaphysician or philosopher to a better understanding of the content, he is satisfied. If the container is called the world-frame (a term free from the ambiguity of æther), the relativist maintains that its geometry is four-dimensional and hyperbolic (semi-Euclidean) in character so long as the content is free from the influence of energy. This may be a condition of absolute rest or it may not. When the content is disturbed and energy manifested, the world-frame geometry is altered, and the world-frame may then be better described as the world-fabric.

Einstein relates the intensity of disturbance to the change in the geometry of the fabric with respect to that of the frame. He does not concern himself with the content of the frame, but only with that content of the fabric which manifests itself as free or bound energy. He leaves it to the metaphysician to deduce

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that the content of the frame is the content of the fabric in absolute rest, or to make any other deduction he logically can. He does not pretend to explain what energy is or what it may become if reduced to absolute rest. He does not assert that there is no absolute rest, but that it escapes his and all experience.

JOHN G. MCHARDY,
Commdr. R.N. (Retired).

16 Ebury Street, S.W.1, May 6.

### The Production of Metallic Zinc.

IN the issue of NATURE for April 28 I observe under "Notes" (p. 279) a reference to the small volume on zinc recently issued by the Imperial Mineral Resources Bureau. In this reference it is pointed out that the figures relative to the production of metallic zinc in the United Kingdom for 1913 do not harmonise with the figures of production and imports of zinc-ore. Naturally so, for there are other factors involved in the production of metallic zinc in any given year. The output of metallic zinc is not necessarily derived entirely from the ores produced at home or imported in that particular year; the part played by "secondary" production—that is, metal obtained from hard zinc—is of importance in this connection.

As regards the use of the expression "long ton," to which the writer of the note objects, preferring the words "statute ton," it has been made abundantly clear in the prefaces to the Bureau's publications that "the weights are expressed in long tons—that is to say, the British statute ton of 2240 lb." The ton of 2240 lb., though the "statute" ton in the United Kingdom, is not necessarily the "statute" ton in other countries. The expression "long ton" has not only the advantage of conciseness, but it is also well understood throughout the mining and metallurgical world.

R. A. S. REDMAYNE,
Chairman of the Imperial Mineral
Resources Bureau.

2 Queen Anne's Gate Buildings,
Westminster, London, S.W.1.
May 4.

SIR RICHARD REDMAYNE puts forward two explanations to account for the discrepancy in the statistics published by the Imperial Mineral Resources Bureau. The first of these, namely, that stocks of ore may be carried over from year to year, is, in view of the relatively small differences from year to year, inadequate to account for the great discrepancy noted. The second is, in fact, the true explanation. Secondary zinc accounts for about one-half of the so-called zinc output of the country, and thus seriously affects the statistics.

THE WRITER OF THE NOTE.

### The Theory of Vision.

PROF. JOLY'S papers on vision are very interesting. He adopts the visual purple as the visual substance, but there is no evidence that the rods are percipient elements. The view that they are percipient elements is based on errors, as, for instance, that certain animals—the tortoise is the most quoted—possess only cones; that the periphery of the retina is colour-blind; and that the Purkinje phenomenon is not found with the fovea. The tortoise has the rods and cones as definitely marked and distinct from each other as in man. Has any reader seen a retina in which there are only rods or only cones in any animal? The periphery of the retina is not colour-blind. Red of sufficient luminosity can be seen to the extreme periphery. The Purkinje phenomenon is found with the fovea, and is a photochemical phenomenon. It is very improbable that the rods are percipient elements. An elaborate nervous mechanism is required to regulate the sensitiveness of the photochemical film, and this appears to be the function of the rods.

The stimulus in vision is undoubtedly liquid, as shown by the movement of positive after-images.

The decomposition of the visual purple stimulates the ends of the cones. The ends of the cones consist of a series of discs varying in diameter.

F. W. EDRIDGE-GREEN.

May 7.

### A New British Land Planarian.

MR. MORISON'S discovery of the interesting planarian worm (*Rhynchodemus Scharffi*) in a garden at Chiswick, as described in Prof. Dendy's letter in NATURE of May 5 (p. 298), shows that this species has a wider range than was at first anticipated. As Prof. Dendy states, it was first discovered in a Dublin garden in 1894, but since that date it has turned up in the Royal Botanic Gardens at Glasnevin, Dublin. I thought it had probably been introduced into both localities, but that nevertheless it was indigenous to Ireland.

It seemed to me most likely to have been brought from the country with a load of turf. This view was confirmed when, in April, 1901, I found several specimens of this planarian worm in the open country under a fallen tree-trunk near Ballymote, Co. Sligo (see *Irish Naturalist*, vol. x., 1901, p. 133).

R. F. SCHARFF.

National Museum, Dublin, May 12.

### Cutting Sections of Cotton Hairs.

IN our laboratory we have now, for some months, utilised Mr. H. J. Denham's plan for celloidin-paraffin embedding of the cotton hairs, on the lines of Kultschitzky's and other processes (Worden: "The Nitro-cellulose Industry," p. 805), described in NATURE of May 5, p. 299, which Mr. Denham kindly communicated to us when he first suggested it, and we have found it most satisfactory. We immerse the hairs in dilute celloidin, which is then boiled down to a syrup (Gilson's process); the hairs are next transferred to paraffin-chloroform, and thence to 60° C. paraffin (Ide's process); this makes a very rapid technique, cut sections being available within two hours. We have also tried the method of Willows and Alexander, but find it cytologically inferior to this celloidin-paraffin technique, which gives us excellent sections at $2{\cdot}5\mu$ setting on a Leitz sliding microtome, with accidental sections even thinner.

W. LAWRENCE BALLS.
H. A. HANCOCK.

Experimental Department,
The Fine Cotton Spinners' and
Doublers' Association, Ltd.,
Manchester, May 13.

### British Scientific Instruments.

IN the review of the "Dictionary of British Scientific Instruments" published in NATURE of May 12, p. 324, it is stated that the British Optical Instrument Manu-

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